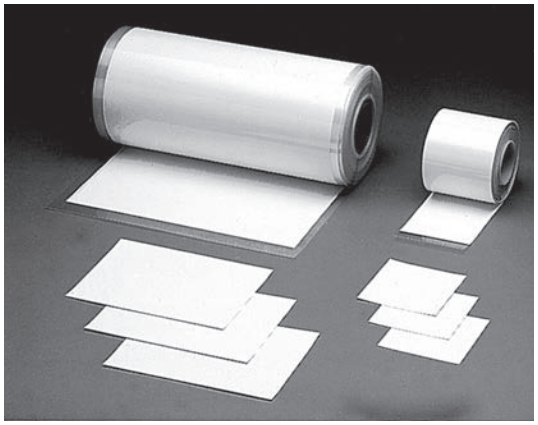
Composite Powder for Low Temperature Cofired Ceramics

Composite powder for low temperature cofired ceramics is a composite material that is made by uniformly blending glass and ceramic fillers. Firing can be conducted at a low temperature in the range of 870-900°C, which allows the use of highly conductive elements such as gold and silver paste to create a screen print circuit pattern with high electric properties.

- MLS-25M is a vitreous material with a low CTE* and a low dielectric constant.
- MLS-25E is a vitreous material with a very low dielectric constant.
- MLS-41 is a devitrifiable material with a high dielectric constant.
- MLS-23K is a new product with a low dielectric constant and low tan δ .
- MLS-26 is a devitrifiable material with high mechanical strength.
- MLS-63 is a devitrifiable material with high mechanical strength and low tan δ .

*CTE : coefficient of thermal expansion



Green sheets

Properties

Properties/Glass Code			MLS-25M	MLS-25E	MLS-41	MLS-23K	MLS-26	MLS-63
Bending strength		MPa	157	125	250	150	320	400
Dielectric constant	1MHz, 25°C		4.9	3.9	17.0	3.9	7.1	8.0
	15GHz, 25°C		4.8	3.9	19.0	4.0	6.7	7.9
tan δ	1MHz, 25°C	$\times 10^{-4}$	25	5	20	5	4	5
	15GHz, 25°C	$\times 10^{-4}$	47	21	50	15	58	11
Coefficient of thermal expansion	30-380°C	$\times 10^{-7}$/K	42	60	84	65	58	87
Density*		$\times 10^{3}$kg/m^{3}	2.52	2.29	4.36	2.24	3.02	3.52
Transformation point		°C	500	500	700	525	625	725
Volume resistivity Log ρ	150°C	Ω·cm	13.5	>14	—	>13.8	12	>14
Thermal conductivity		W/m·K	1.9	1.7	3.1	1.7	3.9	4.1
Particle size	D_{50}	μm	3.3	3.5	1.1	1.0	2.6	1.6
	D_{max}	μm	20	20	10	15	15	10
Glass type			$SiO_2 \cdot B_2O_3$		$Nd_2O_3 \cdot TiO_2 \cdot SiO_2$	$SiO_2 \cdot B_2O_3$	$SiO_2 \cdot CaO \cdot Al_2O_3$	

*Powder theoretical density

Application Examples

Method

1. Casting and Printing

Glass-ceramic powder, binder resin, solvent, and plasticizer are thoroughly mixed and cast into a 50-300 µm thick green sheet using the doctor blade method. Individual sheets are cut into appropriate sizes from the green sheet and punched with via holes and then screen-printed with a circuit pattern.

2. Lamination

Green sheets are laminated at 50-100°C and under 10-35 MPa pressure.

3. Firing

Firing is carried out in the air.

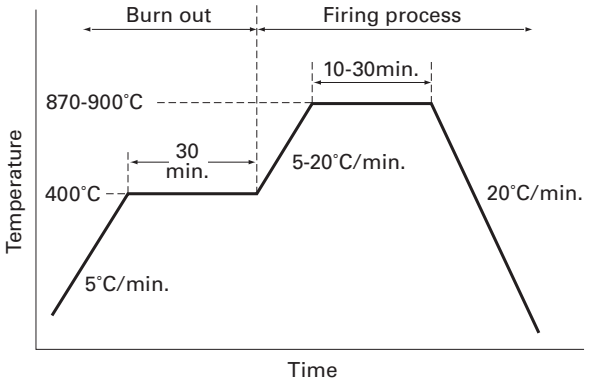
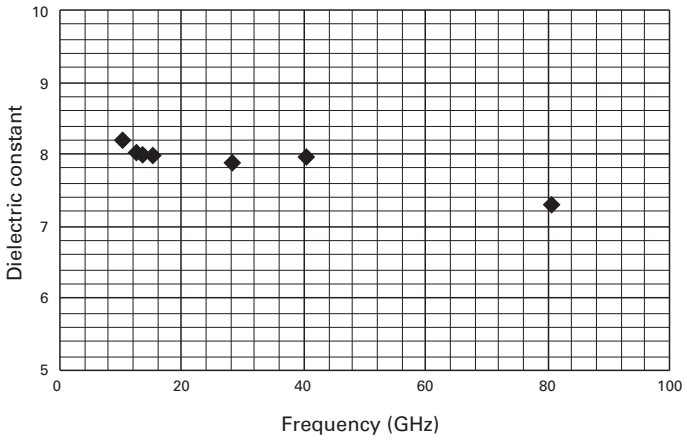


Fig. 1 Firing profile

High Frequency Dielectric Properties of MLS-63

Dielectric constant



tan δ